REMARKS

Reconsideration of the rejections set forth in the Office Action is respectfully requested. By this amendment, claims 4 and 13-16 have been canceled without prejudice or disclaimer, claims 1-3, 5-9, and 11-12 have been amended, and new claim 17 has been added. Currently, claims 1-3, 5-12, and 17 are pending in this application.

Rejection under 35 USC 103

Claims 1-3 and 15 were rejected under 35 USC 103 as unpatentable over Liu (U.S. Patent No. 6,744,727). This rejection is respectfully traversed in view of the amendments to the claims and the following arguments.

Liu teaches a system that determines the optimal spare capacity allocation (SCA) by a network. (See e.g. Col. 8, lines 57-65). The Examiner has stated that Liu does not explicitly teach combining only a first and second path. However, the Examiner has taken the position that it would be obvious to do so, stating that Liu globally teaches optimizing the spare capacity in link backup paths citing Col. 11, lines 40+ and Col. 12, lines 20+. To understand how these aspects of Liu are working, applicants would like to take a step back and first discuss Fig. 1 of Liu, as this will shed light on how the other cited aspects of Liu operate to calculate the optimal spare capacity allocation.

In the lower right hand corner of Fig. 1, Liu shows a network topology having nodes a-e and links 1-7. Liu then defines a set of flows (flows 1-10) with each flow extending between a pair of nodes on the network topology. Thus, for example, flow 1 extends from source node a to destination node b. Flow 2 extends from source node a to destination node c, etc. This is shown directly to the left of the network topology in Fig. 1. (See Liu at Col. 6, lines 10-24). Liu assumes bidirectionality, and hence only considers each pair of nodes (each flow) one time. (Liu at Col. 6, lines 29-32).

For each flow, Liu will calculate a working path and a backup path. The path through the network will be the series of links that are used to carry traffic between the source and destination nodes that define the flow. Any common path calculation mechanism may be used to determine the working and backup paths. Liu mentions, for example, that one of the shortest path algorithms may be used to calculate the working path (Liu at Col. 7, lines 42-45) and that a

shortest path algorithm may also be used to calculate the backup paths (Liu at Col. 8, lines 11-14).

Once Liu has calculated a working path (series of links between a source and destination node) and a backup path (second series of links between the source and destination nodes), Liu creates what are referred to as "link-incidence" matrices. The link incidence matrices simply represent the use of particular links by working/protection paths through the network. For example, Liu teaches that a first "link-incidence" matrix may be created to aggregate, or group together, all the various working paths into one matrix. (Liu at Col. 6, line 64 to Col. 7, line 14). Specifically, Liu creates a vector for each working path. The vector has elements corresponding to the links on the network. Each element within the vector contains a value of 1 if the link is used by that particular working path and contains a value of 0 if the link is not used by a particular working path. (Id.). Thus, a vector for flow a6 (between source node b and destination node d that uses links 3 and 5 would have a link incidence vector [0 0 1 0 1 0 0]. (Liu at Col. 7, lines 6-8). Note, in this vector, that all of the links that are not used by the working path are represented by a 0 entry, while the two links that are used by the working path are represented by a 1 entry.

The working path link incidence matrix A is created by aggregating all of the vectors for all of the working paths into one matrix. This is shown as the bottom matrix of Fig. 1. The link-incidence matrix thus shows which flows use which links on the network.

Liu does the same thing for the protection paths. Specifically, for each protection path (series of links determined to be used to protect traffic between a source/destination pair), Liu will create a vector representing those links that are used by the protection path for the flow. (See Liu at Col. 7, line 46 to Col. 8, line 10). The vectors are created the same way and then are aggregated to form a transposed backup path link-incidence matrix Bt.

Thus, both the working path link incidence matrix and the backup path link incidence matrix simply hold indications of which links are used to carry traffic for flows between all source/destination pairs on the network. The entries in the matrix are "1" if a link is used for a particular working path/protection path, and "0" if the link is not used for that working/protection path.

As mentioned above, Liu's objective is to determine the spare capacity allocation for the network. To do this, Liu teaches at Col. 8, lines 16-33, that a spare provision matrix should be

created by forming the product of the backup-path link-incidence matrix with a vector (m) and the working path link-incidence matrix. The vector m is used to allow different network resources other than capacity to be represented (Liu at Col. 8, line 25-29). Working traffic for a given link is then determined by summing the elements in a column of the working-path incidence matrix, i.e., looking at how many working paths use a particular link (Liu at Col. 8, lines 47-56), while the spare capacity is determined from the elements of the spare provision matrix C (Col. 8, lines 34-43).

As is clear from this explanation, Liu looks at the network as a whole and determines the entire set of working paths and protection paths. In this context, the spare capacity is determined by multiplying two matrices which contain representations of the use of particular links by working and protection paths. Thus, all of the working and protection path definitions are required to create a capacity matrix, which may then be used by a network operator to determine how spare capacity should be allocated on the network. (Liu at col. 8, lines 57-65).

The process described and claimed in this application is very different than that of Liu. Specifically, in this application, when a protection path is created that overlaps another existing protection path, the nodes on the path will look to determine if new spare capacity is required to be reserved for the new protection path or if it would be OK to use spare capacity that was previously allocated to the earlier protection path. (See Specification at paragraphs 45-49).

It would not have been obvious to implement this process based on the teachings of Liu. In particular, Liu does not teach or suggest assessing if it is proper for a second channel to use bandwidth allocated to a first channel. Specifically, Liu does not discuss the concept of determining whether sharing bandwidth on a link would be proper or not, but simply looks to determine which paths use a particular link when determining the spare capacity for that link. Applicants have amended claim 1 to include the concept of assessing whether sharing of bandwidth is proper.

Additionally, Liu teaches a system in which calculations are performed on the network as a whole, such that the required spare capacity on a particular link depends on the overall network topology and the paths (working and protection) that were computed through the network (e.g. using a shortest path calculation method). Based on this, it would not make sense to look to perform the process taught by Liu on a link-by-link basis. While Liu is able to determine the spare capacity for a particular link (see Col. 8, lines 49-52) the calculation of the capacity for that

link is based on the capacity matrix which, as described above, relies on the overall link allocation for the network as a whole.

With this understanding in mind, applicants would like to address the sections of Liu cited by the Examiner. Specifically, The Examiner stated in the Office Action (page 2) that Liu teaches globally optimizing the spare capacity in link backup paths in a network, citing col. 11, lines 40+. In this section of Liu, Liu addresses how a network should be configured so that the amount of spare capacity on a link is sufficient to handle path restoration scenarios. (Col. 11, lines 37-39). Liu explains that one way to do this is to sum the total spare capacity that must be reserved on a link to handle failure on node pairs (flows) that have a backup path that spans that particular link. (Col. 12, lines 37-44 and Equation 3). Since this solution simply adds the amount of reserve capacity for each backup path on the link, this does not look at whether it would be proper to determine if one of the flows could use bandwidth from another of the flows.

Liu continues at Col. 12, line 55 to Col. 13, line 39 to describe another way of determining the maximum capacity on a link that must be reserved for backup paths. In the end, Liu concludes after several paragraphs describing the mathematical theory, that this second way condenses to also create the column vectors from the spare provision matrix C discussed in some detail above. Accordingly, this second way of determining the spare capacity of a link also relies entirely on the network topology and the routing of paths through the network. It does not, therefore, include a notion of determining whether it would be proper to allow one flow to share backup bandwidth allocated to another flow when determining the amount of spare capacity to be included at that point in the network.

Applicants have reviewed the claims of this application and have decided to amend the claims significantly to focus prosecution on the method of combining protection paths on a mesh network. The method includes the steps of defining first and second protection paths, and reserving bandwidth for the first protection path. If the first and second paths have an intermediate node in common, the method further recites the step of assessing, by the intermediate node, if it is proper for the second channel on the second protection path to use the reserved bandwidth allocated to the first channel associated with the first protection path. If it is proper, the method further includes the step of allocating the first reserved bandwidth associated with the first channel to both the first protection path and second protection path. Liu fails to

teach or suggest a method of this nature. Accordingly, applicants respectfully request that the rejection of the claims under 35 USC 103 over Liu be withdrawn.

Lau et al.

The Examiner cited Lau et al. (U.S. Patent No. 7,093,160) in connection with rejection of claim 16. Applicants have canceled claim 16 rendering the rejection of claim 16 moot. However, to further prosecution, applicants note that Lau qualifies as prior art against the claims of this application only through reliance on the underlying provisional patent application filed May 3, 2001. Applicants have reviewed the provisional application and it does not appear that the Lau provisional provided support for the portion of the Lau patent cited by the Examiner. Accordingly, if the Examiner believes that a further rejection of one or more claims is warranted based on the teachings of Lau, the Examiner is respectfully requested to cite to portions of the Lau provisional application that support the rejection as not all of the material in the Lau patent was disclosed prior to the filing date of this application.

Conclusion

In view of foregoing remarks, it is respectfully submitted that the application is now in condition for allowance and an action to this effect is respectfully requested. If there are any questions or concerns regarding the amendments or these remarks, the Examiner is requested to telephone the undersigned at the telephone number listed below.

If any fees are due in connection with this filing, the Commissioner is hereby authorized to charge payment of the fees associated with this communication or credit any overpayment to Deposit Account No. 502246 (Ref: NN-14666).

Respectfully Submitted

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